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Performing Onboard Diagnostic System Checks as Part of a Vehicle Inspection and Maintenance Program: Draft Guidance

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*****DRAFT*****

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David Sosnowski and Edward Gardetto

Transportation and Regional Programs Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

****DRAFT****

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Introduction

EPA is issuing this draft guidance at this time for several reasons. First, we are soliciting input on the scope and clarity of this guidance. Second, we are soliciting input from states conducting or preparing to conduct onboard diagnostic (OBD) inspections so as to benefit from their experiences. Responses to these first two concerns will help assure the final guidance is as valuable as possible. Third, we are issuing this draft guidance even prior to finalization of regulations modifying OBD inspection requirements so that we will be in a position to finalize this guidance as soon as the proposed regulatory revisions are adopted as final. This will help to assist those states and local areas that are considering or planning early implementation of OBD inspection programs. Finally, issuing this draft will provide all areas which may eventually adopt OBD inspections with an early indication of the types of issues and concerns we see with implementation of such programs. The recommendations contained in this draft are consistent with an OBD inspection program anticipated by our proposed regulatory amendments. Since these amendments are only proposed and not yet finalized, existing regulations are controlling as to what is acceptable in operating I/M programs. Changes to these proposed amendments reflected in the final rule as well as consideration of responses received to this draft guidance may result in changes to this guidance when it is finalized.

Background

The Clean Air Act as amended in 1990 (CAA) requires the Environmental Protection Agency (EPA) to set guidelines for states to follow in designing and running vehicle inspection and maintenance (I/M) programs. As well as distinguishing between basic and enhanced I/M programs, these guidelines must clarify how states are to meet other minimum design requirements set by the CAA. One such requirement that applies to both basic and enhanced I/M programs is the performance of Onboard Diagnostic (OBD) system checks as part of the required, periodic inspection.

On November 5, 1992, EPA published the I/M rule to meet most of the above-referenced CAA requirements. At the time the I/M rule was published, however, federal OBD certification standards had not been published. To address the CAA's OBD-I/M requirement, EPA reserved sections in the 1992 rule, with the understanding that these reserved sections would be amended at some future date. Although the federal requirement for OBD began with the 1994 model year (MY), manufacturers were allowed to request waivers on vehicles for MY 1994-95, so that the current generation of OBD (also known as OBD II) was not required on all light-duty cars and trucks sold in this country until MY 1996. On August 6, 1996, EPA published amendments to the 1992 I/M rule establishing OBD-I/M performance standard and I/M State Implementation Plan (SIP) requirements. The 1996 amendments also specified data collection, analysis, and summary reporting requirements for the OBD-I/M testing element; established OBD test equipment requirements and the OBD test result reporting format; and identified those conditions that would result in either an OBD-I/M failure or rejection. Lastly, the August 6, 1996 amendments revised 40 CFR part 85, subpart W to establish OBD-I/M as an official performance warranty short test under section 207(b) of the Act.

At the time the original OBD-I/M requirements were established, it was not practical to evaluate the real-world, in-use performance of OBD because the vehicles in question were still too new and the number of those vehicles in need of repair were too few to make pilot testing worthwhile. Therefore, in 1998, EPA further amended its OBD-I/M requirements to delay the date by which I/M programs must begin OBD testing to no later than January 1, 2001.

One of the primary reasons for delaying the deadline for beginning OBD-I/M testing was to give EPA time to evaluate the OBD check as an I/M program element and to give states time to prepare for implementation. In conducting its evaluation of OBD, however, EPA found that identifying and recruiting OBD-equipped vehicles in need of repair proved more difficult and time-consuming than originally anticipated. As a result, EPA has only recently completed its first assessment of OBD-I/M effectiveness and implementation issues. During the course of this evaluation, however, it became clear that certain regulatory changes were needed to ensure the smooth implementation of OBD-I/M testing by the states.

In response to its findings on OBD effectiveness and its study of the various implementation issues associated with OBD-I/M testing, EPA published a notice of proposed rulemaking (NPRM) in the Federal Register on September 20, 2000[1]. Among other things, this notice proposes to: 1) extend the current deadline for mandatory implementation of the OBD-I/M inspection from January 1, 2001 to January 1, 2002; 2) clarify states' options regarding the integration of OBD-I/M checks into existing I/M networks; 3) revise and simplify the current list of Diagnostic Trouble Codes (DTCs) that constitute the OBD-I/M failure criteria to include any DTC that leads to the dashboard Malfunction Indicator Light (MIL) being commanded on; and 4) provide for exemptions from specific readiness code rejection criteria on OBD-equipped vehicles based upon vehicle model year. The goal of the proposed amendments is to update and streamline requirements and to remove regulatory obstacles that would impede the effective implementation of OBD-I/M testing.

In addition to the above cited regulatory requirements and their proposed amendment,

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[1] Copies of the proposed rulemaking are available via the Internet at www.epa.gov/oms/epg/regs.htm.

EPA believes it is important to respond to states' requests to provide additional guidance on how to successfully implement OBD-I/M testing in an I/M program. That is the purpose of this document.

Scope of Guidance

This draft guidance incorporates several key recommendations made to EPA by the OBD Workgroup, which is part of the Mobile Source Technical Review Committee, established under the Federal Advisory Committee Act (FACA). This draft was also developed by drawing from the experiences of several states that are currently performing some form of OBD-based inspection. As of this writing, eight states (California[2], Colorado, Alaska, Illinois, Wisconsin, Vermont, Oregon, and Utah[3]) are performing some form of vehicle OBD system check and at least four other states (Indiana, Maine, Georgia, and New York) are actively moving towards early implementation of vehicle OBD system checks.

This draft guidance reflects EPA's current understanding of the challenges and issues unique to the performance of OBD testing in the I/M program environment, and includes our recommendations for how best to address those issues at this time. As is the case with any technology-driven pollution control measure, our understanding of the issues and the issues themselves are likely to change over time and as we gain more experience with them. Therefore, EPA will update this draft guidance from time to time, as developments warrant.

This draft guidance does <u>not</u> address those I/M implementation issues which are common to all test types and for which there are no unique, OBD-specific considerations. For example, this draft guidance does not address geographic coverage requirements or the adequacy of program funding mechanisms. Readers can find EPA's requirements and/or recommendations for these generic I/M implementation issues by consulting the I/M rule (as amended) and EPA's subsequent I/M policy documents, which are available via the Office of Transportation and Air Quality (OTAQ) web site at: http:\\www.epa.gov\otaq\im.htm.

Lastly, this draft guidance document is a <u>draft</u> which is being circulated specifically to generate comments. In several areas, EPA has identified potentially difficult implementation issues which are unique to OBD (for example, waiver issuance). While an attempt has been made to suggest the shape of possible answers to these problems, EPA welcomes any additional

[2] Currently, California is performing only a visual check for MIL illumination. A scanner check for trouble codes will be added in the future.

[3] In Utah, the I/M program is administered at the county level (as opposed to at the state level). Although there are several counties in Utah currently required to implement I/M, only one county – Davis – has opted to begin early implementation of the OBD-I/M check.

suggestions reviewers may have, as well as insights into possible flaws with the suggestions we have proposed. Readers who choose to provide comments should send them to Dave Sosnowski at:

U.S. Environmental Protection Agency
Office of Transportation and Air Quality
2000 Traverwood Drive
Ann Arbor, MI 48105.

Comments can also be provided by phone (734-214-4823) or via e-mail (sosnowski.dave@epa.gov). Comments are requested by January 12, 2001.

Vehicle OBD System Checks: Basic Requirements

Recommended Model Year Coverage

Although some variety of OBD system has been an option on certain vehicle models since the early 1980's, standardized OBD II systems were not introduced until MY 1994, and such systems did not appear on all new light-duty vehicles sold in this country until MY 1996. Therefore, for I/M purposes, EPA does not require that pre-1996 MY vehicles be subject to the OBD inspection discussed in this draft guidance. Furthermore, EPA does not recommend that such testing include MY 1994-95 vehicles because not all such vehicles are OBD-equipped and the availability to manufacturers of limited waivers from some OBD requirements makes determining which of these vehicles to test (and to what standards) administratively very difficult.

EPA also does not recommend that vehicles older than MY 1994 be subjected to OBD-based I/M testing, even if it is determined that the vehicle is equipped with an OBD computer, and may even have a malfunction indicator light (MIL) illuminated. The reason we do not recommend performing an OBD-I/M scan on pre-1994 MY OBD-equipped vehicles is because such vehicles use an earlier, non-standardized generation of OBD system (also known as OBD I). Due to the lack of federal standards for OBD I systems, the systems themselves tend to be proprietary and may not be compatible with the standardized, generic OBD II scanners that will be used in most I/M programs.

Elements of an OBD-I/M Check

An OBD-I/M check consists of two types of examination: A visual check of the dashboard display function and status (also known as the MIL and/or bulb check) and an electronic examination of the OBD computer itself. These two examinations, taken together, comprise the seven step procedure outlined below.

1) Initiate an official test by scanning or manually inputting the required vehicle and owner information into the reporting medium (i.e., PC-based electronic reporting system or manual test report).

2) Visually examine the instrument panel to determine if the MIL illuminates when the ignition key is turned to the “key on, engine off” (KOEO) position. This portion of the test procedure is also known as the “bulb check.” Enter this information into the reporting medium.

3) Locate the vehicle’s data link connector (DLC) and, with the key in the off position, plug a scan tool into the connector[4]. Given the variety of locations manufacturers have chosen in practice, this may well be the most time-consuming element of the inspection. We will discuss the issue of atypical DLC location elsewhere in this draft guidance.

4) Start the vehicle’s engine and visually check MIL illumination under the “key on, engine running” (KOER) condition.

5) Follow the scan tool manufacturer’s instructions to determine:

    - Vehicle’s readiness status[5]
    - MIL status (whether commanded on or off)[6], and
    - Diagnostic Trouble Codes (DTCs) for those vehicles with MILs commanded on[7].

6) Record the results of the OBD inspection in the appropriate medium. Depending upon the design and feature requirements of the program, this may be an automated process.

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[4] EPA recommends that states use scan tools complying with the Society of Automotive Engineers (SAE) Recommended Practice J1978

[5] Refer to SAE J1979 MODE 01 PID 01 DATA C and D.

[6] Refer to SAE J1979 MODE 01 PID 01 DATA A BIT 7.

[7] EPA’s original requirement for OBD failure was limited to power-train, emission-related DTCs (refer to SAE J1979 MODE 03). In its September 20, 2000 notice of proposed rulemaking, EPA proposed to simplify the failure-triggering DTC criteria to any DTC that leads to the MIL being commanded on.

7) Without clearing DTCs or readiness codes, turn off the vehicle ignition, and then disconnect the scan tool[8]. Clearing codes – if such is necessary – should be reserved for the repair portion of the program (even though in test-and-repair programs, the same personnel may be engaged in both activities).

Although the above inspection elements are listed sequentially, current regulations do not specify the sequence that must be followed in performing the OBD-I/M inspection, and EPA sees no reason for applying a rigid sequence at this time. In some cases it may make more sense to conduct the visual portion of the inspection after performing the onboard computer scan. For example, during its work with the Wisconsin program, EPA found that some MY 1996 Subaru vehicles reset certain monitors to "not ready" whenever the vehicle is turned off. Conducting the bulb check first (which involves shutting off the engine, and then turning the key to the "key on, engine off" position) would result in these vehicles being unnecessarily rejected as "not ready." Similarly, EPA has found that a scan tool can be plugged into a still-running vehicle without mishap. Therefore, we believe states should be allowed the flexibility to determine the optimum test sequence to meet their programmatic needs.

For readers who prefer their information presented graphically, a flowchart of an acceptable OBD system check is included in Appendix F of this draft guidance document. It was developed by the Center for Automotive Science and Technology at Weber State University, and is consistent with EPA draft guidance. As will be discussed below, EPA has proposed revising the I/M rule to allow states to complete the testing process on MY 1996-2000 vehicles with two or fewer unset readiness codes, while for MY 2001 and newer vehicles, the testing process could still be completed provided there is no more than one unset readiness flag. The results of the final rulemaking will be determinative on this issue.

Basis for Failure or Rejection

Unless otherwise noted in this draft guidance, a vehicle should be either failed or rejected for any of the following five reasons:[9]

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[8] For programs conducting both OBD and tailpipe testing on OBD-equipped vehicles the tailpipe test may be conducted prior to this step, to avoid an extra, unnecessary key-off, key-on cycle.

[9] States should be aware that some vehicles have atypical OBD configurations, and should take steps to avoid unfairly penalizing motorists. For example, states may incorrectly suspect motorist tampering for those vehicles that are manufactured with the DLC in an unusual location. States should contact manufacturers to request information on vehicles with atypical OBD configurations on a make/model-specific basis. For example, one manufacturer has developed a "State I/M Program Advisory Notice" to address the problem that some of their 1996 vehicles reset readiness to "not ready" when the vehicle is powered down (turned off). See Appendices B and C for more information on this issue.

1) It is a 1996 or newer vehicle and the data link connector (DLC) is missing, has been tampered with, or is otherwise inoperable. (Action: Failure)

2) The MIL does not illuminate at all when the ignition key is turned to the KOEO position. The MIL should illuminate (on some vehicles, only for a brief period of time) when the ignition key is turned to the KOEO position. (Action: Failure)

3) If the MIL illuminates after the engine has been started, even if no fault codes are present, since this could indicate a serial data link failure.[10] (Action: Failure)

4) Any DTCs are present and the MIL status, as indicated by the scan tool, is commanded on, regardless of whether or not the MIL is actually illuminated. Do not fail the vehicle if DTCs are present and the MIL status, as indicated by the scan tool, is off. MIL command status must be determined with the engine running. (Action: Failure)

5) The number of OBD system monitors showing a "not ready" status exceeds the number allowed for the model year in question. (Action: Rejection)[11]

Table 1 below lists the possible test outcomes in tabular form.

Table 1 – Possible OBD-I/M Outcomes

Vehicle Passes If:	* Bulb check OK and * MIL not lit for any DTCs * All required readiness codes are set

[10] An exception to this condition are a subset of MY 1996 Mercedes vehicles including the following models: C220 (engine family TMB2.2VJGKEK), E320 (engine family TMB3.2VJGKEK), and C280/S320/SL320 (engine family TMB3.6VJGKEK). These MY 1996 models continuously illuminate the MIL whenever a scan tool is connected to the vehicle. All other systems and functions on these vehicles are fully operational. See Appendix E for more information on this issue.

[11] As mentioned previously, although the current rule requires that OBD-equipped vehicles be rejected from further testing if any monitor is "not ready," EPA has proposed to take rulemaking action to revise these readiness criteria to allow states to not reject MY 1996-2000 vehicles with two or fewer unset readiness codes, or MY 2001 and newer vehicles with no more than one unset readiness flag. The complete MIL check and scan should still be run in all cases, however, and the vehicle should still be failed if one or more DTCs are set and the MIL is commanded on. The vehicle should also continue to be rejected if the OBD computer does not set readiness codes for 3 or more monitors on MY 1996-2000 vehicles, or two or more monitors on MY 2001 and newer vehicles. Readiness codes in general, and the specific codes and conditions covered by the September 20, 2000 proposal, will be discussed in more detail under a separate section of this draft guidance.

Vehicle <u>Fails</u> If:	* Bulb check not OK <u>and/or</u> * MIL lit (or commanded on) for any DTC <u>and/or</u> * DLC missing, tampered, inoperable
Vehicle <u>Rejected</u> If:	* More unset readiness codes found than allowed based on MY <u>and/or</u> * DLC cannot be located or is inaccessible

<u>I/M-Related DTCs</u>

Currently, Federal I/M regulations identify a subset of power train (or P-code) DTCs as being relevant for I/M purposes. If a vehicle is identified through an I/M program as having a MIL commanded on for one or more of these P-codes, then Federal regulations require that the vehicle fail the inspection. However, in an attempt to simplify these failure criteria – and to harmonize Federal requirements with CARB requirements – EPA has proposed to change this requirement so that a vehicle would be failed for the presence of <u>any</u> DTC that results in the MIL being commanded on.

EPA also wants to acknowledge that it is possible we may need to limit the criteria for failing OBD-equipped vehicles after they reach an as-yet undetermined age and/or mileage. The reason for considering this possibility stems from the fundamental difference between how OBD triggers repairs versus how traditional tailpipe tests trigger repairs. Traditional I/M tailpipe tests identify a vehicle as failing for a given pollutant through direct sampling of the exhaust plume. These tests vary in the degree to which they provide any additional information that can be used to target the component or system failure that has led to these high emissions. In such programs, repair technicians have a fair degree of discretion when it comes to recommending repairs to address a given failure, although owners are protected from excessive economic hardship by the cost waiver option. OBD, on the other hand, identifies specific components and/or systems in need of repair or replacement. As a result, EPA foresees the possibility that some advanced-aged OBD-equipped vehicles could be failed for DTCs for which the only available repair option would cost substantially more than the fair market value of the vehicle itself, while providing very limited environmental benefit. Under such a scenario, the waiver option does not offer much consumer protection, since such repairs tend to be all-or-nothing propositions. For example, a motorist faced with a transmission repair cannot reasonably opt to have the transmission "half fixed" to take advantage of the cost waiver option.

Given the relative newness of OBD II, EPA has not been able to gather the data necessary to determine whether situations like the one above will actually happen in practice. We do believe however that program requirements should be reasonable, and that the economic burdens of a program should be balanced by the environmental benefit likely to result from the imposition of those burdens. Therefore, we may revise our failure criteria at some future date, once data has been gathered and analyzed concerning the relative cost-effectiveness of repairing high mileage/age OBD-equipped vehicles across the full range of possible MIL-triggering DTCs.

Test Report

If a vehicle fails, the test report given to the motorist should include the status of the MIL illumination command and the alphanumeric fault code(s) listed along with the DTC definition(s) as specified per SAE J2012 and J1930. Only the fault codes leading to the inspection failure should be listed on the report given to the motorist. EPA makes this recommendation because it is possible that an OBD system may set DTCs without commanding a MIL to be illuminated. These DTCs usually reflect an intermittent condition which may or may not be a problem at the time of testing. If the condition does not recur within a certain number of trips, the code will eventually be cleared; if the condition does recur, the system may then determine that a MIL should be illuminated. Therefore, no DTCs should be printed on test reports for vehicles that pass the inspection. An owner who receives notice of these codes on the same sheet of paper with notification of passing the state inspection may become confused or desensitized to the importance of DTCs and the MIL. Lastly, unset readiness codes should also be listed on the report if the number of unset readiness codes exceeds the limit for which an exemption is allowed (i.e., if the outcome of the test is rejection based upon the presence of too many unset readiness codes). If the number of unset readiness codes falls below the limit for which an exemption is allowed (and the vehicle would otherwise pass the inspection) then no unset readiness codes should be listed on the test report provided to the motorist.

Readiness Status: Initial Test

The OBD system monitors the status of up to 11 emission control related subsystems by performing either continuous or periodic functional tests of specific components and vehicle conditions. The first three testing categories — misfire, fuel trim, and comprehensive components — are continuous, while the remaining eight only run after a certain set of conditions has been met. The algorithms for running these eight, periodic monitors are confidential to each manufacturer and involve such things as ambient temperature as well as driving conditions. Most vehicles will have at least five of the eight remaining monitors (catalyst, evaporative system, oxygen sensor, heated oxygen sensor, and exhaust gas recirculation or EGR system) while the remaining three (air conditioning, secondary air, and heated catalyst) are not necessarily applicable to all vehicles. When a vehicle is scanned at an OBD-I/M test site, these monitors can appear as either "ready" (meaning the monitor in question has been evaluated), "not ready" (meaning the monitor has not yet been evaluated), or "not applicable" (meaning the vehicle is not equipped with the component monitor in question).

There are several reasons why a vehicle may arrive for testing without the required readiness codes set. These reasons include the following:

1) Failure to operate the vehicle under the conditions necessary to evaluate the monitor(s) in question;

2) A recent resetting of the OBD system due to battery disconnect or replacement, or routine maintenance prior to testing;

3) A unique, vehicle-specific OBD system failure;

4) An as-of-yet undefined system design anomaly; or

5) A fraudulent attempt to avoid I/M program requirements by clearing OBD codes just prior to OBD-I/M testing (by, for example, temporarily disconnecting the battery).

Because unset readiness codes <u>could</u> be a sign of attempted fraud, it is important that all OBD-equipped vehicles be checked to confirm that readiness codes have been set as one of the pre-requisites for a valid OBD-I/M inspection. Nevertheless, as described in the NPRM, EPA also believes that the current requirement regarding readiness codes (i.e., that a vehicle be rejected from further testing if <u>any</u> monitor is found to be “not ready”) is more rigorous than is necessary or practical. Therefore, as discussed under “Basis for Failure or Rejection” above, EPA has proposed to revise the current readiness requirement to allow states to complete the testing process on MY 1996-2000 vehicles with two or fewer unset readiness codes; for MY 2001 and newer vehicles, the testing process could still be complete provided there is no more than one unset readiness code. This does not mean that these vehicles are exempt from the OBD-I/M check. The complete MIL check and scan must be run in all cases, and the vehicle still must be failed if any of the failure criteria discussed in this draft guidance are met. The vehicle should continue to be rejected if it is MY 1996-2000 and has three or more unset readiness codes or is MY 2001 or newer and has two or more unset readiness codes.

As discussed in the draft Technical Support Document to the September 20, 2000 NPRM, this proposal is based upon EPA’s findings regarding readiness codes from Wisconsin’s OBD-I/M data and also reflects a FACA workgroup recommendation. Since August 1998, Wisconsin’s I/M program contractor has been sending EPA OBD scanning and IM240 test results data collected on MY 1996 and newer vehicles coming through the Wisconsin I/M test lanes. In analyzing the Wisconsin data, EPA made the following observations regarding the readiness status of the OBD-equipped vehicles presented for testing:

- The majority of vehicles showing up at the I/M lane with readiness codes reading "not ready" were from MY 1996; the "not ready" rate for MY 1996 vehicles was 5.8%.

- The frequency of vehicles with readiness codes reading "not ready" dropped off with each successive model year — to 2.2% for MY 1997 and 1.4% for MY 1998.

- If an exemption were allowed for up to two readiness codes to read "not ready" before a vehicle would be rejected from further testing, the rejection rate drops — to 2.2% for MY 1996 and to 0.2% for MY 1997 and MY 1998, for a three model year average of 0.9%.

The intention behind EPA's proposal to allow limited exemptions from the readiness rejection criteria is the desire to reduce the potential for customer inconvenience during this start-up phase of OBD-I/M testing. EPA believes that the environmental impact of this exemption will be negligible, given the small number of vehicles involved, the likelihood that at least some of these readiness codes will have been set in time for subsequent OBD-I/M checks, and the fact that an unset readiness code is not itself an indication of an emission problem. EPA believes that allowing limited exemptions from the readiness code requirement as described above makes the most sense at this time, while EPA, CARB, and the manufacturers work to clarify system function requirements with regard to I/M. Lastly, EPA does not believe that allowing these limited exemptions will interfere with the use of readiness codes to help deter possible fraud because such fraud would inevitably lead to more monitors being set to "not ready" than are allowed under EPA's proposed limited exemptions.

In addition to the above exemptions, EPA also recommends that I/M programs allow readiness exemptions for vehicles with known readiness design problems. EPA has compiled a list of such vehicles and included it in Appendix D. Even with these and the above exemptions, however, some vehicles will still need to be rejected based upon readiness code status. In the case of a vehicle rejected for unset readiness codes (which does not otherwise meet the failure criteria described in this draft guidance), the motorist should be given the option of operating the vehicle for an extended period of time under assorted operating conditions in an attempt to evaluate the necessary monitors without being required to visit a repair facility prior to retesting. If the monitors still have not evaluated by the first retest, the motorist should then be advised to visit a repair facility.

In all cases, it is important to emphasize that lack of readiness is a special status particular to OBD systems and that the vehicle is not necessarily producing excess emissions. Instead, the vehicle's emissions status is officially "Unknown," due to a failure to meet certain monitoring conditions prior to the inspection. States should provide a written statement about OBD and readiness status to drivers in order to minimize confusion.

Readiness Status: Retest After Repairs

OBD-I/M programs also must address the readiness code status of vehicles returning for retesting after repairs have been performed to correct an initial OBD-I/M failure. Assessing the readiness status of a vehicle after repair can be even more challenging than it is for the initial test, because vehicles that return to the I/M lane immediately following repair will likely have just had the fault code memory cleared by the repair technician (the proper step following a repair). Upon clearing the fault code memory, however, all readiness codes will also be cleared and set to "not ready." If the vehicle returns for retesting immediately after repair, the probability is high that one or more readiness codes will register as "not ready" (even if the vehicle showed all readiness codes as "ready" on the initial test).

Because the goal of the retest is to confirm that the vehicle in question has been properly repaired, EPA believes requiring the submission of repair receipts as proof of repair is appropriate, in the event that a vehicle is presented for retesting with an excessive number of unset readiness codes. EPA appreciates that the ability of inspectors to confirm repairs prior to retesting will vary, depending upon whether the I/M program is a test-and-repair or test-only program. In the case of test-only programs, outreach efforts to the repair community should stress the importance of including an indication on the repair receipt that the repairs in question are OBD-related (i.e., by including the diagnostic scan in an itemized list of services performed). A repair receipt (as opposed to a repair estimate) including evidence of a diagnostic scan and dated either on the same day as the initial test or sometime thereafter may be considered adequate for establishing proof-of-repair for retest purposes in test-only programs. In the case of owner-performed repairs, the program should require the submission of appropriately dated parts receipts prior to retesting, and these receipts should be reviewed by the test station manager, who in turn should be trained to determine whether the parts in question are relevant to the cause of failure. EPA believes that the number of vehicles falling into this last category (i.e., OBD-equipped vehicles that fail the initial test and return for retesting with owner-performed repairs and an excessive number of unset readiness codes) should be relatively small.

If a vehicle is failed on its initial OBD-I/M test but also has unset readiness codes for which it was not rejected due to an initial test readiness exemption, EPA recommends that the vehicle continue to be waived from the retest readiness requirement should those same readiness codes remain unset when the vehicle is presented for retesting. These recommendations are based upon suggestions made by the OBD Workgroup under the Federal Advisory Committee Act (FACA). EPA believes that this approach allows the greatest flexibility in verifying a repair while limiting the chances of fraudulent activity.

Evaporative System Testing and OBD

EPA's analysis of the Wisconsin I/M lane data suggests that OBD-I/M testing can be supplemented by including a separate gas-cap check. When EPA compared failure rates for the evaporative portion of the OBD-I/M test to the failure rate for the stand-alone gas cap test we found that the separate gas cap test was able to identify a substantial number of leaking gas caps that were not identified by the OBD monitors due to different failure thresholds.

The seeming disparity described above is a result of the different detection thresholds for the two tests. The stand-alone gas cap test was designed to detect a leak as small as 60 cubic centimeters per minute (cc/min) at a pressure of 30 inches of water, while OBD systems were designed to detect leaks equal to a circular hole 0.040 inches in diameter. The 0.040 inch hole equates to a flow rate in excess of 2,600 cc/min at 10 inches of water column (i.e., the maximum allowable internal tank pressure using the enhanced evaporative emission test)[12]. As a result, an OBD system can reliably detect a loose or missing gas cap, while a properly tightened but leaking gas cap that can easily be identified by the gas cap test will probably not be identified by OBD.

Since the gas cap test is able to identify an excessive emission condition not identified by OBD, EPA recommends including this additional testing element in those areas that need substantial reductions in hydrocarbons (HC) from mobile sources as part of their ozone attainment plans. At this point, however, EPA is reserving judgement regarding whether or not gas cap testing should be added to an OBD testing regime in areas with more modest air quality needs with regard to mobile sources. We are reserving judgement in this instance because we still do not have sufficient data to draw reliable conclusions concerning the frequency of leaking gas caps in the in-use fleet. We also have not quantified the emission reduction effectiveness of identifying and correcting leaks between these two detection thresholds. Our efforts in these areas have been complicated as a result of pre-inspection replacement of the gas cap and, in some cases, a failure by inspectors to record the initial gas cap failure as a failure. During informal audits of such programs, EPA has found that the faulty gas cap is frequently replaced on the spot, or the owner is directed to simply replace the cap later without being required to return for a retest.

Implementation Issues for Centralized vs. Decentralized OBD-Based Testing

While EPA assumes that centralized I/M programs will integrate OBD-I/M test procedures into an overall, PC-based, real-time data-linked testing system, we also anticipate that some decentralized programs may opt for generic, stand-alone, handheld scanners (i.e., no PC, no keyboard or bar-code reader for data entry, no real-time data-link). EPA sees

[12] During its pilot testing of OBD evaporative monitor effectiveness, EPA found that some in-use OBD systems were capable of detecting leaks from holes as small as 0.020 inches in diameter. A 0.020 inch hole equates to 600 cc/min at 10 inches of water column.

several drawbacks to the stand-alone approach to OBD-I/M testing. For example, the lack of a real-time data link will mean that program oversight will necessarily be more costly, more labor intensive, and also less comprehensive, leaving the program perhaps more vulnerable to fraud. This decrease in program oversight effectiveness would come at a time when the program itself is reverting to what is, in effect, a manual test program, where test reports are filled out by hand from information read off a handheld scanner's screen. Historically, programs that rely upon a non-automated process for making pass/fail decisions have been found to be even more difficult to oversee than traditional decentralized programs, since no electronic record is produced, making auditing more difficult. Furthermore, the use of computer matching to identify non-complying vehicles would be seriously restricted under such a system, assuming that such a system would not result in an electronically scannable testing database. And while it is possible that manually-completed test reports could be made computer-scannable and collected during site visits or sent to the state, the inherent time lag between the test and inclusion in the state database makes this a challenging implementation issue (i.e., a negative hit could equal data lag, not necessarily non-compliance). Lastly, the individual station's access to extensive and important program information (for example, data connector location databases and technical service bulletins regarding program updates, pattern failures, etc.) would be limited, both in terms of availability and timeliness.

At a minimum, EPA believes that for an OBD-I/M test program to be effective -- whether centralized or decentralized -- it should be designed in such a way as to allow for:

- Real-time data link connection to a centralized testing database;
- Quality-controlled input of vehicle and owner identification information (preferably automated, for example, through the use of bar code); and
- Automated generation of test reports.

<u>OBD and Inspector Fraud</u>

As is the case with all other I/M test types, the OBD-I/M check is vulnerable to inspector fraud, and program managers need to be on guard to limit the opportunities for this kind of activity. For example, it is currently possible for an unscrupulous inspector in a tailpipe-based program to engage in a practice known as "clean piping," where a known-clean vehicle is tested while the vehicle identification information for another (presumably dirty) vehicle is entered into the test record. Similarly, there is a limited opportunity for an inspector to "clean scan" an OBD-equipped vehicle, but also methods for keeping this type of activity in check. The opportunity for "clean scanning" exists because the vehicle identification number (VIN) is not currently included in the data stored in the vehicle's onboard computer. Unlike "clean piping," however (where almost any known-clean vehicle will do), the opportunity for large-scale “clean scanning” can be greatly reduced through the use of identity-limiting information which is currently available from the vehicle’s OBD system. For example, programs could tally the number of Parameter Identification (PID) requests exchanged between the OBD computer and scan tool, which will produce a number that can be used as a check against the other vehicle information entered into the test record. Another important number to capture and track for quality control purposes is the Powertrain Control Module (PCM) identification number. While these numbers do not identify a vehicle down to the level of an individual registration and owner, they do allow for the separation of vehicles into different makes, models, and engine families. Put another way, the PID count and PCM identification number for a Honda Accord will be different from that of a Ford Escort. Therefore, programs can limit the potential for fraud via “clean scanning” by comparing the PID count and/or the PCM identification number to the other vehicle information in the test record. EPA is working with manufacturers and states currently implementing the OBD-I/M inspection to gather the data necessary to interpret PID count and PCM identification information so it can be used for this purpose.

Repair Cost Waivers and OBD

Though for equity reasons it may be difficult for states to eliminate the waiver option for OBD-equipped vehicles, EPA recommends that states consider at least modifying waiver requirements for such vehicles. The reason for wanting to avoid granting a waiver to a vehicle with an illuminated MIL is two-fold: 1) it reinforces bad behavior (i.e., ignoring illuminated MILs) and 2) once lit, a MIL that was turned on for a relatively minor problem effectively eclipses new, major problems, should they develop. At a minimum, the state’s public education efforts regarding the OBD inspection should stress the importance of responding to illuminated MILs in a timely manner. States should also consider requiring that a vehicle pass an OBD-I/M inspection as a condition prior to change-of-ownership. Under such a scenario, it would be illegal to sell a used, OBD-equipped vehicle with MIL-triggering DTCs set, a missing or tampered DLC, and/or an illuminated or malfunctioning MIL.

Public Outreach

In recognition of the pivotal role repair technicians and the public play in the success of I/M programs, EPA recommends that all states required to perform vehicle OBD system checks begin public outreach and technician training six months to a year prior to the beginning of mandatory OBD testing[13]. Therefore, another reason for issuing this draft guidance at this time is to give states the opportunity to consider the various issues raised by and addressed in this draft guidance in the development of their public outreach and technician training efforts. The need for public outreach is also one of the reasons EPA has proposed to delay the deadline for mandatory OBD testing from January 1, 2001 to January 1, 2002.

To facilitate a smooth transition from traditional I/M testing to OBD-based testing on OBD-equipped vehicles, states should not underestimate the importance of effective public outreach campaigns to inform motorists about OBD and how it works, what the MIL is and how to respond to it, and the environmental and consumer benefits of OBD. Thorough explanation of the OBD system within the context of I/M testing may guard against the negative public perception which accompanied the introduction of loaded mode testing in many areas. Extra care may need to be taken in areas where loaded mode testing made the state emissions testing a "hot button" issue.

Once developed, public educational materials should be disseminated as widely as possible. Relevant distribution points include: Trade organizations, dealerships, AAA newsletters, private garages, owners manuals for MY 1996 and newer vehicles, EPA publications, auto shows, drive-time radio advertisements, automotive magazines, and environmental public service announcements. In pursuing their public outreach efforts, states should be sure to involve all relevant parties in the process of developing and distributing materials. These include: State legislators, local leaders, automobile manufacturers, automobile enthusiasts, scan tool manufacturers, EPA regional offices, emission inspection contractors, environmentalists, health professionals, AAA, technical colleges, service writers, private garages and repair chains.

Technician Training

The success of a state's OBD-I/M effort will also depend on making sure that the repair community is prepared to address the sorts of vehicles that are identified by the OBD scan as needing service and/or repair. States should work with their local educational institutions, OBD equipment vendors, and other training providers to ensure that the necessary training is available to repair technicians in the field well in advance of mandatory

[13] EPA also recommends that states consider factoring in a month or more of voluntary, advisory-only testing to allow inspectors and motorists to get accustomed to the program and to allow for debugging prior to the beginning of mandatory testing with mandatory repairs upon failure. Under such a scenario, a vehicle would be given a complete OBD-I/M test with the exception that vehicles would not be failed on the basis of the OBD-I/M check alone, and would, instead, be issued an advisory notice indicating that the vehicle is experiencing a problem for which it will be failed if corrective action is not taken prior to the next test cycle.

OBD-I/M testing. In addition, states should also work with the various organizations representing the repair community to stress the need for repair technicians to take advantage of the training opportunities that are available.

In states where I/M testing and repair are performed by the same entity, OBD-specific technician training should be required as a prerequisite to licensing or certification. Such training should address the following topics, at a minimum:

- The basics of OBD (i.e., theory, terminology, legal requirements, etc.)
- The differences between OBD I and OBD II
- The OBD-I/M inspection procedure
- The pass, fail, and rejection criteria for OBD-equipped vehicles
- Readiness, the setting and clearing of codes, MIL-triggering vs. pending DTCs
- The link between OBD-I/M and the environment
- Proper diagnostic procedures and available sources of diagnostic materials (i.e., manufacturers, hotlines, web sites, etc.)

APPENDIX A

Glossary of I/M- and OBD-Related Terms

Basic I/M: A vehicle inspection and maintenance program designed to meet the basic I/M performance standard which includes performance of an idle test on 1968+ passenger cars. Under the 1990 Amendments to the Clean Air Act, basic I/M is required in moderate nonattainment areas, as well as those areas already implementing or required to implement a basic I/M program prior to passage of the 1990 Amendments.

"Check Engine" Light: See the definition for Malfunction Indicator Light (MIL) below.

Diagnostic Trouble Codes (DTCs): An alphanumeric code which is set in a vehicle's onboard computer when a monitor detects a condition likely to lead to (or has already produced) a component or system failure, or otherwise contribute to exceeding emissions standards by 1.5 times the certification standard.

Enhanced I/M: A vehicle inspection and maintenance program designed to meet one of three enhanced I/M performance standards – high, low, and ozone transport region (OTR) low. The high enhanced standard is designed around IM240 tailpipe testing and purge and pressure evaporative system testing. The low enhanced standard is similar to the basic I/M performance standard, but includes light-duty trucks and a visual antitampering inspection. The OTR low enhanced performance standard is designed for areas which would not be required to do I/M at all, save for their location within the Northeast Ozone Transport Region. The OTR low enhanced standard is based upon tailpipe testing using remote sensing devices and visual antitampering inspections. Serious and worse nonattainment areas are required to implement enhanced I/M, as well as all areas within the OTR with populations over 100,000, regardless of attainment status.

Evaporative System Test: A test of a vehicle's evaporative control system to determine if the system is 1) leaking and/or 2) purging properly.

Malfunction Indicator Light (MIL): Also known as a Check Engine light, the Malfunction Indicator Light of MIL is illuminated on the dashboard when conditions exist likely to result in emissions exceeding standards by 1.5 times or worse. Alternatives include "Service Engine Soon," as well as an unlabeled icon of an engine.

Onboard Diagnostics (OBD): A system of vehicle component and condition monitors controlled by a central, onboard computer designed to signal the motorist when conditions exist which could lead to a vehicle's exceeding its certification standards by 1.5 times the standard.

****DRAFT****

OBD Data Link Connector (DLC): The interface – usually located under the dashboard on the driver's side – between a vehicle's OBD computer and the OBD scanner. Connecting an OBD scanner to the DLC allows I/M inspectors and vehicle repair technicians to read the readiness status of the vehicle's various onboard monitors as well as any diagnostic trouble codes (DTCs).

Readiness Code: A status flag stored by a vehicle's onboard computer which is different from a DTC in that it does not indicate a vehicle fault, but rather whether or not a given monitor has been run (i.e., whether or not the component or system in question has been checked to determine if it is functioning properly).

Scanner or Scan Tool: A PC-based or handheld device used to interface with a vehicle's onboard computer for the purpose of reading DTCs and monitor readiness status.

Test-and-Repair: An I/M program which allows the same people who test a vehicle to also repair the same vehicle and retest it to determine whether or not the repairs performed were adequate. Test-and-repair programs are also generally decentralized, though not all decentralized programs are necessarily test-and-repair.

Test-Only: An I/M program – usually, though not exclusively centralized – which requires that the functions of testing and repair be performed by different, financially unrelated parties.

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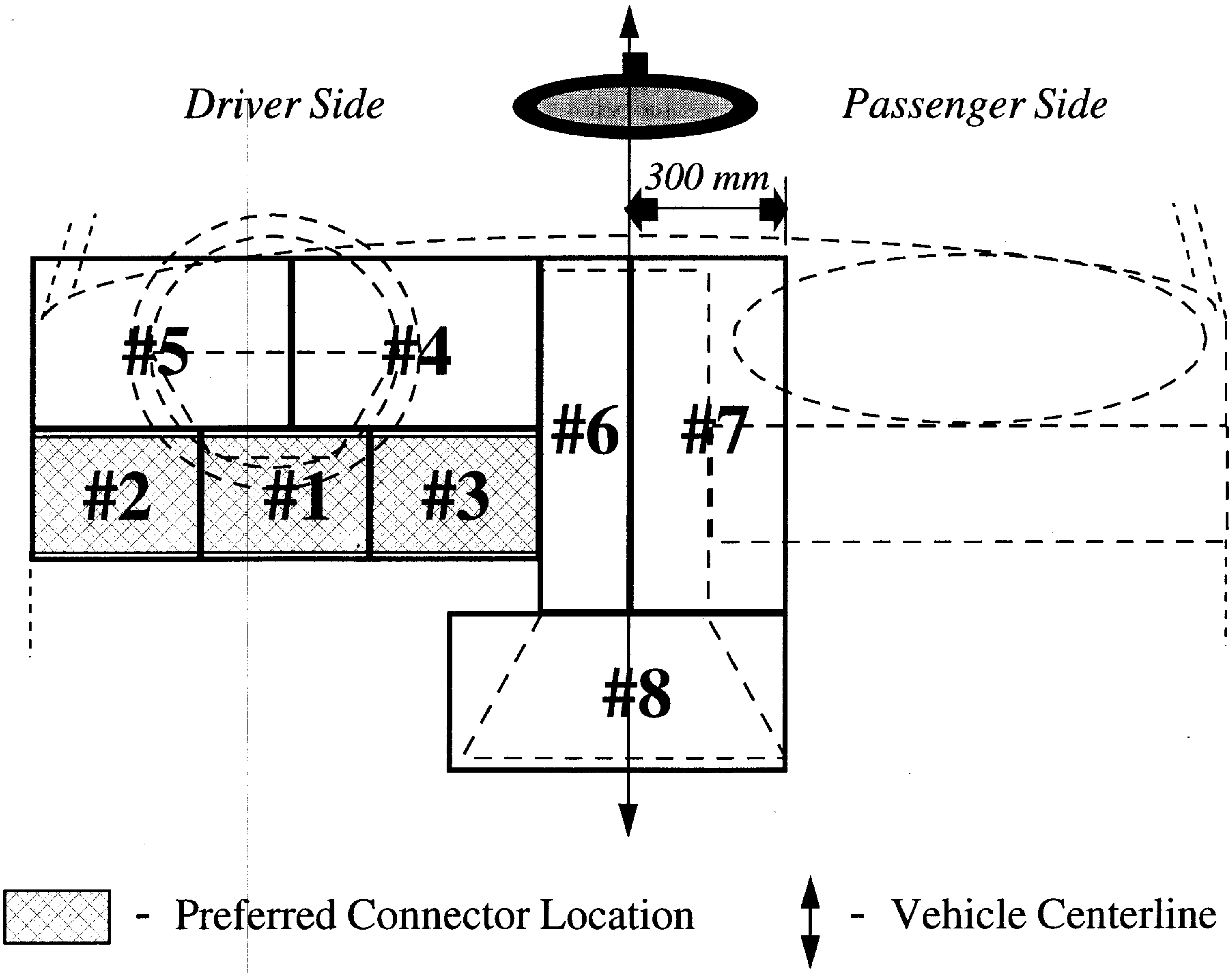
APPENDIX B

Data Link Connector Mapping Diagram

Diagnostic Link Connector Mapping Diagram



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Diagnostic Link Connector (DLC) Mapping Diagram Explanation

The mapping diagram of DLC locations contains a divided instrument panel (IP) with numbered areas. Each numbered area represents specific sections of the IP where manufacturers may have located DLCs. This document briefly clarifies the numbered locations on the mapping diagram. We will use this mapping diagram to catalog manufacturer responses to the recent 208 letter requesting OBD DLC locations for 96MY and future vehicles. Areas 1-3 fall within the preferred DLC location while the remaining areas, 4-8, fall into the allowable DLC location according to EPA requirements. Areas 4-8 require that manufacturers label the vehicle in the preferred location to notify parties of the alternate connector location.

Preferred Location(s)

Location #1:
This location represents a DLC positioned on the underside of the IP directly under the steering column (or approximately 150mm left or right of the steering column). Visualizing the underside of an IP divided into three equal parts from inside the passenger compartment, this represents the center section.

Location #2
This location represents a DLC positioned on the underside of the IP between the steering column and the driver s side passenger door. Visualizing the underside of an IP divided into three equal parts from inside the passenger compartment, this represents the left section.

Location #3
This location represents a DLC positioned on the underside of the IP between the steering column and the center console. Visualizing the underside of an IP divided into three equal parts from inside the passenger compartment, this represents the right section.

Allowable Location(s)

Location #4
This location represents a DLC positioned on the upper part of the IP between the steering column and the center console (but not on the center console, see location #6).

Location #5
This location represents a DLC positioned on the upper part of the IP between the steering column and the driver side, passenger door.

Location #6

This location represents a DLC positioned on the vertical section of the center console and left of the vehicle center line.

Location #7

This location represents a DLC positioned 300 mm right of the vehicle centerline either on the vertical section of the center console or on the passenger side of the vehicle.

Location #8

This location represents a DLC positioned on the horizontal section of the center console either left or right of the vehicle center line. This does not include the horizontal section of the center console that extends into the rear passenger area (see location #9).

Location #9

This location, not shown, represents any DLC positioned in an area other than those mentioned above (e.g., in the rear passenger area on the driver side armrest).

APPENDIX C

Atypical Data Link Connector Locations*, by Make and Model Year

(*Location numbers refer to DLC map in Appendix B)

Manufacturer	Year	Model	Location/ Access	Comments
Audi	1996, 1997	Cabriolet, A6	9/cover	rear ashtray
Bentley	1996-2000	all	9/cover	in glove box
BMW	1999-2000	3 Series	2/cover	1/4 turn slot head screw
BMW	1996-1998	3 Series (including '96-'99 M3)	2/cover	1/4 turn slot head screw
BMW	1996-2000	5 Series	2/cover	1/4 turn slot head screw
BMW	1996 - 2000	7-series	6/cover	under stero cntrl
BMW	1996-2000	X3/M Roadster	7/cover	passenger side of console
BMW	1996 - 2000	Z3-series	9/cover	under passgr. dash
Ferrari	1996-2000	all	3/open	up high under the dash board
Ford	1996	Bronco	7/cover	
Ford	1996	F Series	7/cover	
Ford	1996, 1997	Thunderbird/Cougar	7/cover	
Honda	1996 - 1997	Accord	6/cover	behind ashtray
Honda	1997-1998	Acura CL	7/open	under passgr. dash
Honda	1999	Acura CL	8/open	above shifter
Honda	1999-2000	Acura RL	8/cover	in front of shifter behind ashtray
Honda	1996-1998	Acura TL	8/cover	behind ashtray
Honda	1999-2000	Acura TL	6/cover	below radio next to seat heater control
Honda	1997-2000	CR-V	7/open	under passgr. dash
Honda	1996-2000	DelSol/Hybrid	7/open	under passgr. dash
Honda	1996-1999	Integra	7/open	under passgr. dash
Honda	1997-2000	NSX, S2,000	7/open	under passgr. dash
Honda	1996- 1998	Odyssey	7/cover	console under passgr. dash
Honda	1997- 2000	Prelude	7/cover	under passgr. dash
Honda	1996	Prelude	8/open	above shifter
Honda	1996-1998	Acura RL	7/open	passenger side center console front
Hyundai	1996-1998	Accent	2/open	in coin box
Lexus	1996	ES300	2/cover	behind fuse box panel
Lexus	1996- 2000	LS400	2/cover	above parking brake
Lotus	1997 - 2000	Esprit	7/open	Above Passenger Dash
Mazda	1998-1999	Miata	2/cover	behind fuse box panel
Mitsubishi	1996	Expo	2/open	behind fuse box
Porsche	1996	All Vehicles	6/cover	driver's side of console
Rolls- Royce	1996-2000	all	9/cover	in glove box
Rover	1997	Defender	6/cover	under parcel tray
Rover	1996 - 2000	Range Rover	7/open	under passngr dash
Subaru	1996-2000	Legacy	2/cover	behind plastic hinged cover
Subaru	1996- 1997	SVX	1/cover	right side of steering column
Toyota	1996	Avalon	2/cover	behind fuse box panel
Toyota	1996	Camry	2/cover	behind coin box
Toyota	2000	New Hybrid	7/open	
Toyota	1996 - 1997	Previa (2/4 WD)	6/cover	top instrumt panel
~~Toyota~~	~~1996-1998~~	~~Tercel~~	~~2/cover~~	~~behind fuse box panel~~
Volvo	1997-1998	850	8/cover	in front of shifter under coin tray
VOLVO	1998 - 1999	all vehicles except S80	9/cover	hand brake area
Volvo	2000	C/S/V 70	8/cover	
Volvo	2000	S/V 40	6/cover	
VW	1996-1998	Cabrio, Golf, Jetta	7/cover	right side of ashtray
VW	1996-1999	Eurovan	4/cover	on dash behind wiper lever
VW	1999	Golf,Jetta	7/cover	
VW	1996 - 1997	Passat	4/cover	on dash behind wiper lever

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APPENDIX D

<u>Manufacturers Known to Have OBD Readiness Issues</u>

1996 Chrysler vehicles - Vehicles will clear readiness at key-off unless reprogrammed with up-dated software. These vehicles should be reprogrammed according to Chrysler Technical Service Bulletin # XXXXXXXX.

1996 Subaru vehicles - Vehicles will clear readiness at key-off. There is no reprogramming available for this line of vehicles. These vehicles should be scanned for MIL illumination without regard to readiness status. Subaru Technical Service Bulletin #XXXXXXX.

1996 Nissan vehicles and 1997 Nissan 2.0 liter 200SX - These vehicles may have a high degree of "Not Ready"for catalyst and evaporative monitors due to a "trip based" design. Nissan has provided driving cycles in its service information to allow monitors to operate. These vehicles should be treated as other non-problematic vehicles. Nissan Technical Service Bulletin #XXXXXXX.

1997 Toyota Tercel and Paseo - Vehicles will never clear the evaporative monitor to "Ready". At this time no fix is available. Vehicles should be scanned using remaining readiness monitors as described for non-problematic vehicles.

1996 - 1998 Mitsubishi vehicles - These vehicles may have a high degree of "Not Ready" due to a "trip based" design. Mitsubishi has provided driving cycles in its service information to allow monitors to operate. These vehicles should be scanned for MIL illumination without regard to readiness status. Mitsubishi Technical Service Bulletin #XXXXXXX.

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APPENDIX E

Mercedes Scanner Connection Issue

Mercedes-Benz

Vehicles Illuminating the MIL During DTC Readout

Model Year:	Engine Family:	Vehicle Models:
1994	RMB2.2VJGCEK	C 220
	RMB3.2VJGCEK	C 280 S 320 SL 320
1995	SMB2.2VJGFEK	C 220
	SMB3.2VJGFEK	C 280 S 320 SL 320
1996	TMB2.2VJGKEK	C 220
	TMB3.2VJGKEK	E 320
	TMB3.6VJGKEK	C 280 S 320 SL 320

On the above mentioned vehicles, during DTC readout, the CHECK ENGINE MIL is continuously illuminated.

If you have any additional questions regarding OBD on Mercedes-Benz vehicles, please contact:

Emission Control & Fuel Economy Department
c/o Mercedes-Benz of North America
One Mercedes Drive
Montvale, New Jersey
07645-0350

PiekarskiW@MBUSA.com E-mail

Model Year 1994 USA
Models 124, 129, 140

E320 SL S

Introduction into service

OBD II fault recognition

The diagnostic module recognizes faults as follows:

- **Fault reports**
  from the following control modules via the controller area network (CAN) :
  - HFM-SFI control module (N3/4)
  - Engine 104: CC/ISC control module (N4/3) or EA/CC/ISC control module (N4/1).

EA = Electronic Accelerator
CC = Cruise Control
ISC = Idle Speed Control

Model coding
The diagnostic module (OBD II) is supplied in one version. Model and engine adaptation takes place via the ground connection on pins 7, 8 and 10.

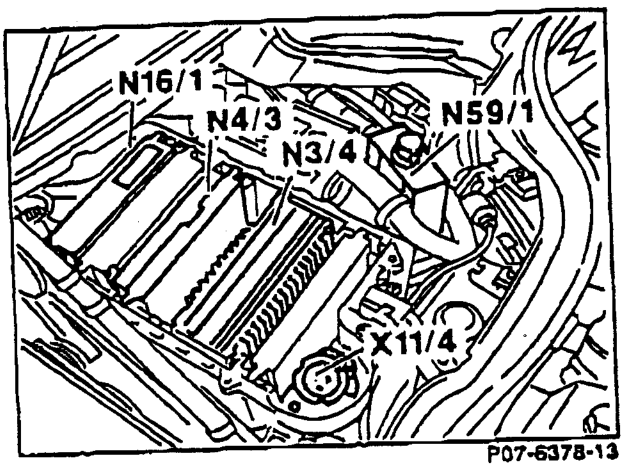
Diagnostic trouble code (DTC) readout
The diagnostic module (OBD II) (N59/1) uses two different plug connectors for the diagnostic trouble code (DTC) readout. The DTC's can be read selectively as follows:

- **Readout with Hand-Held Tester (HHT)** via data link connector (DTC readout) (X11/4) (readout with impulse counter scan tool is no longer possible).

- **Readout with a Generic Scan Tool** via diagnostic module (OBD II) generic scan tool connector (X11/22)
  (Standard communication corresponding to SAE-standard, ISO 9141 CARB).
  According to regulatory requirements, DTC's can be read with a generic scan tool (readout via the pushbutton switch with LED has been eliminated).

Note:
During the DTC readout, the CHECK ENGINE MIL is continuously on.

- **Fault path tests**
  Under specified operating conditions certain control paths are checked e.g. for short circuit, open circuit, implausible signals and illogical combinations.
- **Logic chains**
  The diagnostic module triggers test cycles for:
  - air injection,
  - exhaust gas recirculation,
  - camshaft timing adjuster,
  - charcoal canister purging,
  - transmission upshift delay.



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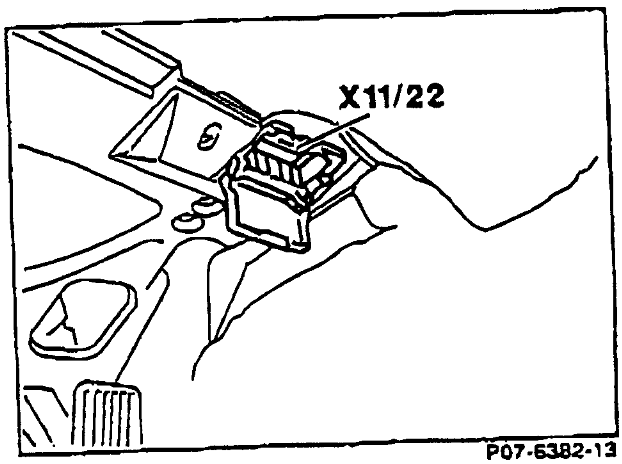

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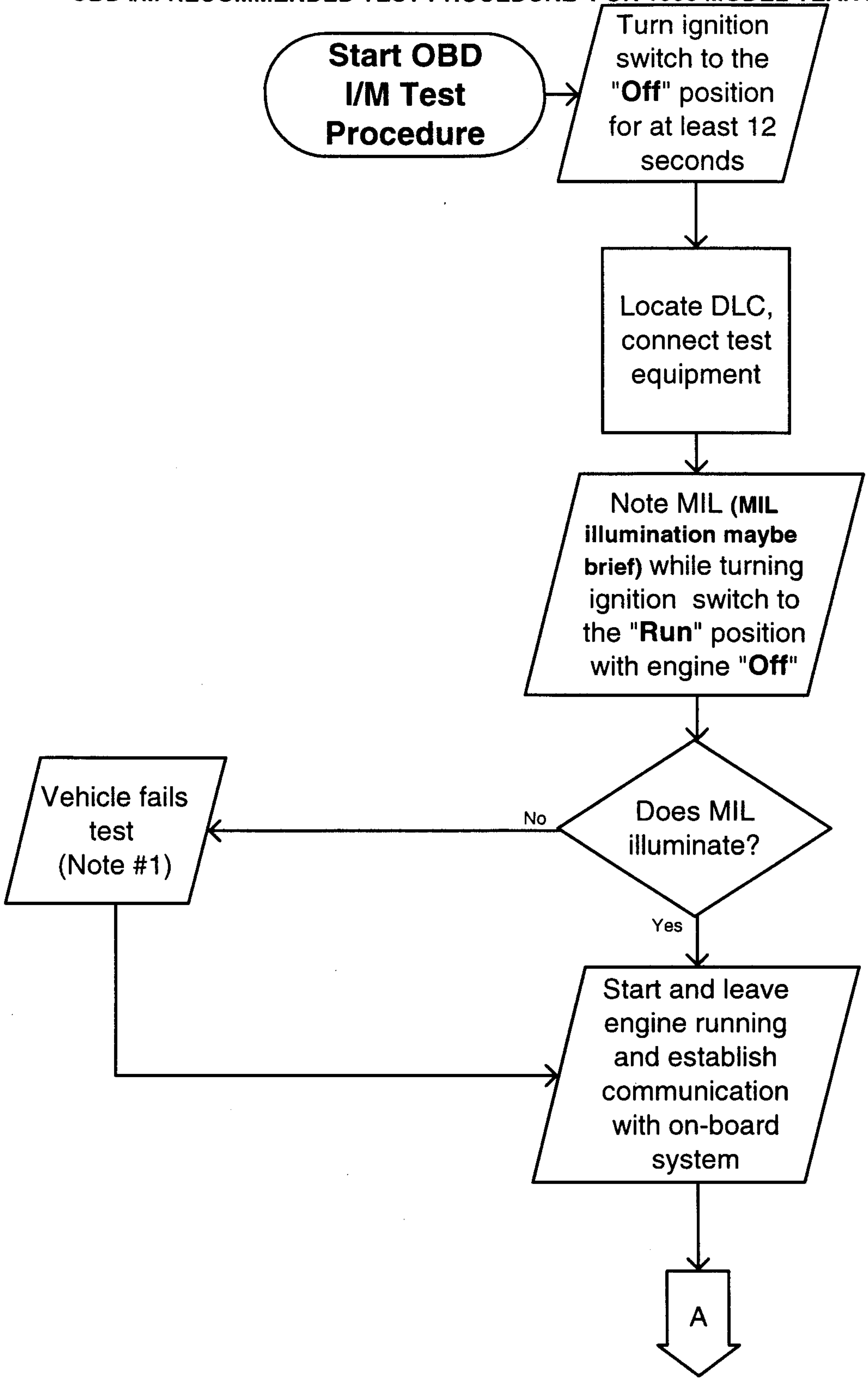
APPENDIX F

OBD-I/M Test Procedure Flow Chart

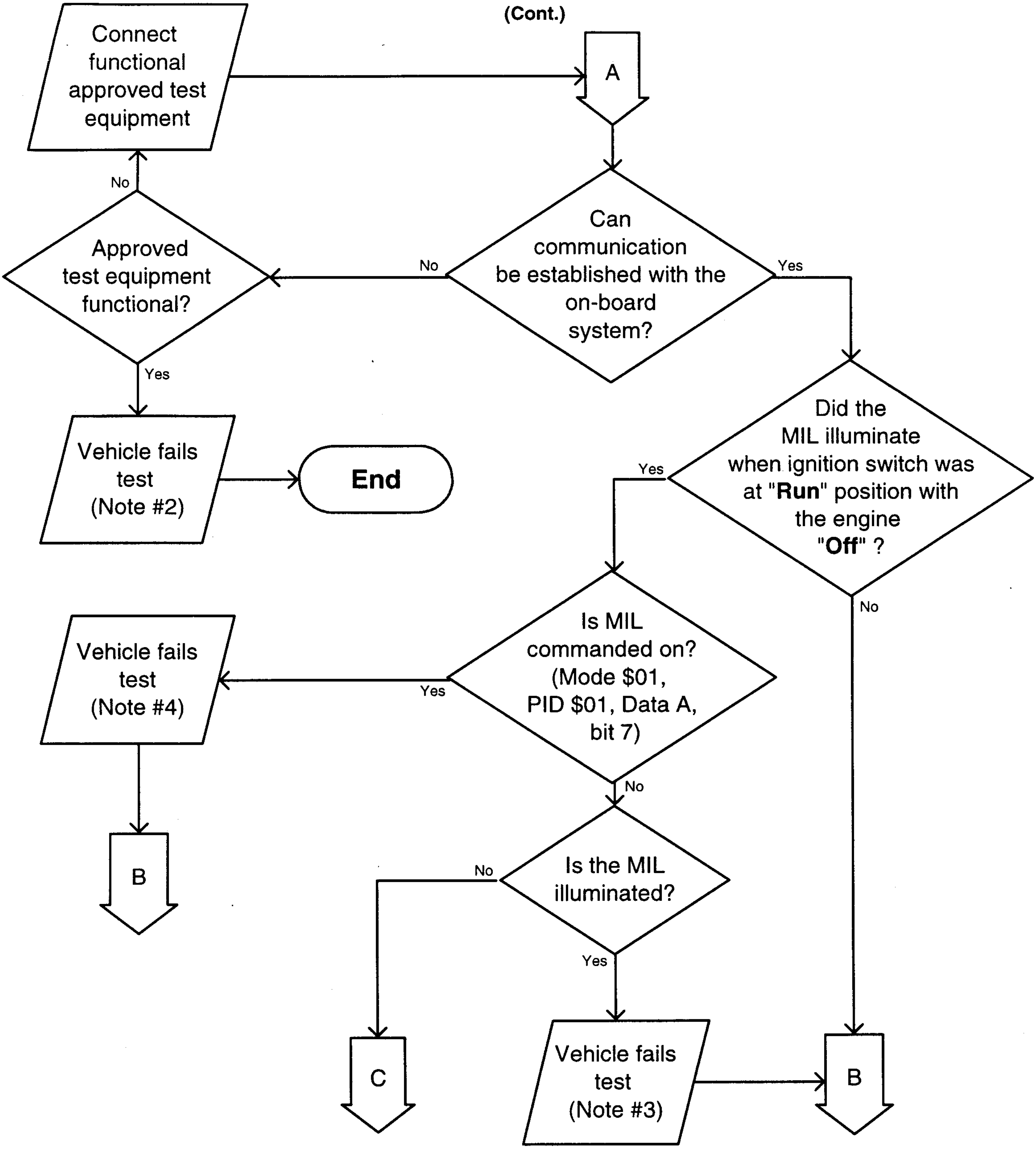
OBD I/M RECOMMENDED TEST PROCEDURE FOR 1996 MODEL YEAR AND NEWER VEHICLES



Center for Automotive Science and Technology
Weber State University

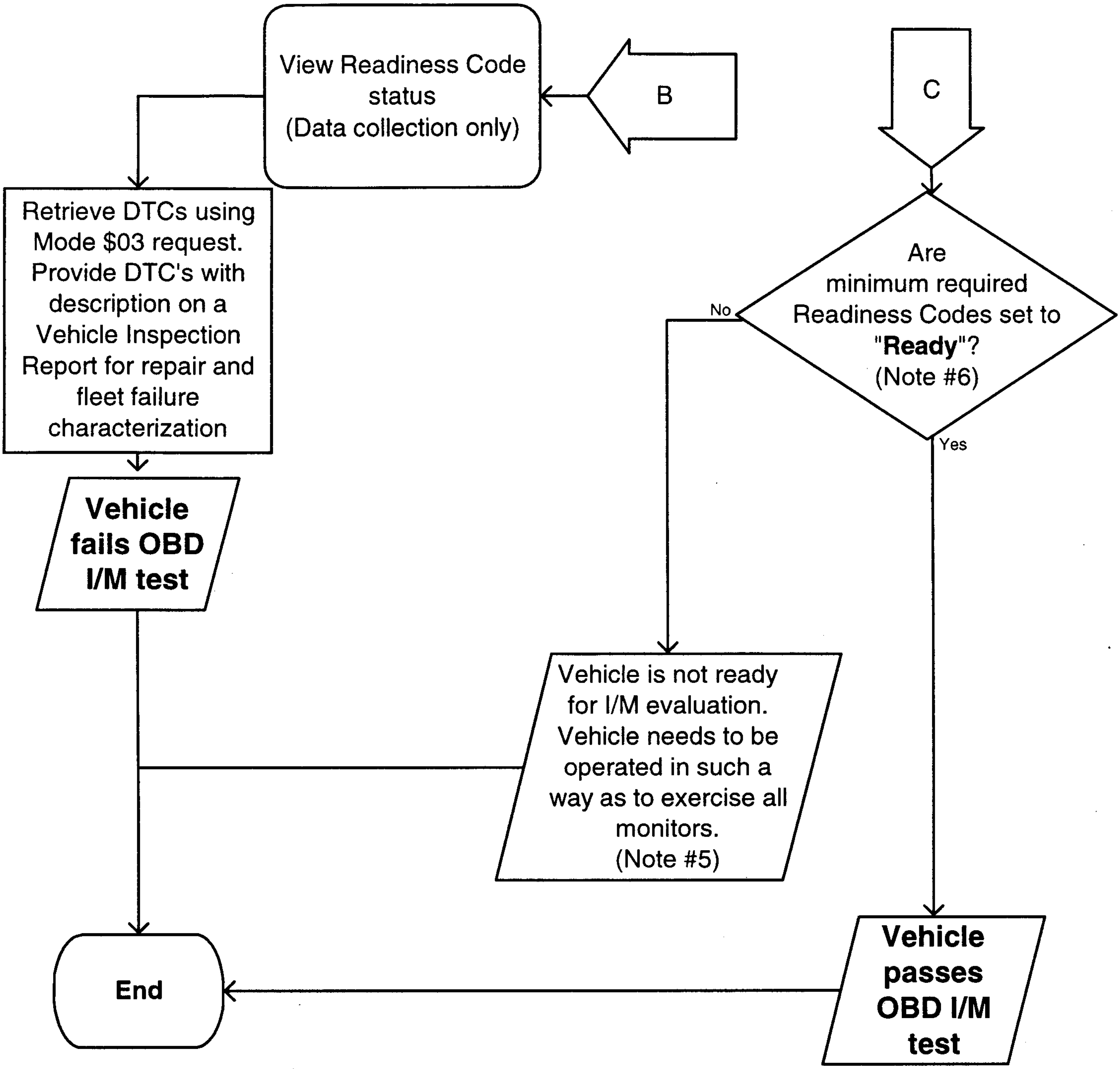
OBD I/M RECOMMENDED TEST PROCEDURE FOR 1996 MODEL YEAR AND NEWER VEHICLES

(Cont.)



Center for Automotive Science and Technology
Weber State University

OBD I/M RECOMMENDED TEST PROCEDURE FOR 1996 MODEL YEAR AND NEWER VEHICLES (Cont.)



Center for Automotive Science and Technology
Weber State University

Notes on flow chart:

Note 1: The purpose of this step is to verify the On-Board Diagnostic (OBD) system has control of the Malfunction Indicator Light (MIL) and the MIL is functional. Operation of the MIL varies between vehicle manufacturers. Key On Engine Off (KOEO) typically results in the MIL on steady, however, there are systems which will illuminate the MIL only briefly during KOEO. In either situation MIL presence and illumination capability has been established.
If the vehicle fails the I/M test at this point, the vehicle inspection report should indicate the MIL problem should be repaired and also include information gathered during the remaining I/M test steps.

Note 2: It is important for the I/M testing personnel to verify proper diagnostic equipment operation before failing the vehicle. If the diagnostic equipment is functional then the vehicle's communication problem must be resolved.
Without communication between the OBD system and the test equipment the I/M test must be ended and the problem resolved before further interrogation of the vehicle can be performed. This step includes identification of Data Link Connector (DLC) tampering, serial data circuit problems and any other condition that would prevent the OBD system from communicating with the test equipment.

Note 3: I/M test failure is a result of MIL illumination even though the OBD system has not commanded the MIL on, or has stored any Diagnostic Trouble Codes (DTCs); e.g., a serial data line failure between the OBD computer and the Instrument Panel.

Note 4: I/M test failure is a result of both the actual and commanded state of the MIL. DTCs should be stored since the MIL is <u>commanded</u> on. A vehicle <u>**should not**</u> fail an I/M test when DTCs are stored but there is no MIL on; e.g., the DTC was stored by a loose gas cap which was subsequently tightened.

Note 5: Readiness Code status must be identified at this stage in the I/M test to determine whether or not all emission control systems have been tested by the OBD system. If any one (or more) Readiness Code(s) are not set ("ready") the OBD system has not yet completed testing of the system(s) and failures may be present but not yet identified. It is important to understand that the vehicle <u>**does not**</u> fail the I/M test at this point; no emission related faults have been identified. The current state of the vehicle's emission control system is **undetermined**.
The emission control systems and related components are tested under specific vehicle operating conditions. Therefore, to set the Readiness Codes the vehicle must be operated within these specific conditions (commonly referred to as "enable criteria") for the OBD system tests to be performed. Once testing of an emission control system is complete, the related Readiness Code will be set ("ready"). When all Readiness Codes are set, the vehicle is ready for further I/M testing.
It will be at the states discretion whether to recommend the customer drive the vehicle to

set the Readiness Codes or to take the vehicle for service. The state may also choose to use a dynamometer drive cycle.

Note 6: EPA has proposed to revise the current readiness code requirement to allow states to complete the testing process on model year 1996 thru 2000 vehicles with two or fewer unset readiness codes; for model year 2001 and newer vehicles, the testing process could still be complete provided there is no more than one unset readiness code. It is important to understand that the vehicle **does not** fail the I/M test because an unset readiness code is not itself an indication of an emission problem with the vehicle.